14. A trench MOSFET transistor device comprising:

a silicon drain region of N-type conductivity;

a silicon body region of P-type conductivity provided over said drain region, said drain region and said body region forming a first junction;

a silicon source region of N-type conductivity provided over said body region, said source region and said body region forming a second junction;

source metal disposed on an upper surface of said source region;

a trench extending through said source region, through said body region and into said drain region; and

a gate region comprising a silicon dioxide layer lining at least a portion of said trench and a doped polycrystalline silicon region within said trench adjacent said silicon dioxide layer, wherein (a) said body region is separated from said source metal by said source region, (b) said source and drain regions comprise the same doping material, (c) said source and drain regions have peak net doping concentrations that are greater than a peak net doping concentration of said body region, and (d) a doping profile along a line normal to upper and lower surfaces of said device is such that, within said body region and within at least a portion of said source and drain regions, the doping profile on one side of a centerplane of the body region is symmetric with the doping profile on an opposite side of said centerplane.

In brief, it is the Office's contention that, while Mogi et al. may not teach limitation "(b)" in claim 1 (and hence limitation "(d)" in claim 14), Vinson does teach this feature "for the specific purpose of retaining electrical symmetry." See Office Action at p. 4. The Applicants respectfully traverse this rejection, and their supporting remarks follow.

In order to establish a *prima facie* case of obviousness under 35 U.S.C. 103, the references, when combined, must teach or suggest all limitations of the claims. Moreover, there must be some suggestion or motivation to modify/combine the references. See MPEP §2143.

The references, however, do no not teach or suggest all limitations of claims 1 and 14. For example, Vinson is directed to a VMOS field effect transistor for a dynamic memory cell. Fig. 1 is directed to what Vinson refers to as a typical V-MOS field effect transistor. Vinson notes that layer 14 within this structure is P-type with a graded dopant concentration profile. Col. 2, lines 56-57. Vinson further notes that "[b]ecause this graded-concentration profile region 14 exists in the MOS transistor channel, it will control the threshold voltage of that transistor and give that transistor asymmetrical electrical characteristics." Col. 2, lines 57-61.

Vinson goes on to propose the device of Figs. 4A-4C, in which "the channel region does not have a graded concentration profile and therefore will have symmetrical electrical characteristics." Col. 4, lines 36-39 (emphasis added).

The Office Action asserts that "the doping profile (characterized by constant doping concentration) on one side of a center plane of the body region is symmetric with the doping profile on an opposite side of the center plane." In this connection, it is noted that the portion of Vinson referred to in support of this statement, col. 6, lines 28-32 reads as follows: "Such a field effect transistor can be achieved without the formation of a graded dopant concentration in the channel between the source and drain areas of the transistor, thereby retaining electrical symmetry." Thus, Vinson is refers only to the dopant concentration *in the channel between the source and drain regions* i.e., in the *body region.*

Claims 1 and 14, on the other hand, both require "a doping profile ... such that, within said body region *and within at least a portion of said source and drain regions,* the doping profile on one side of a centerplane of the body region is symmetric with the doping profile on an opposite side of the centerplane." (Emphasis added.)

Vinson, on the other hand, does not teach or suggest that the "symmetry" (i.e., constant doping) of the p-type body region described therein should extend into the source and drain regions, and Vinson makes no attempt to control the doping profiles within the source and drain regions such that at least a portion of the source region is symmetric with at least a portion of the drain region. Note that Vinson uses two fundamentally different techniques to form the source and drain regions: diffusion to form the drain 25 (see col. 3, line 25) and ion implantation to form the source 32 (see col. 4, lines 23-27).

For at least the above reasons, it is respectfully submitted that Mogi et al. and Vinson, even when combined, do not teach or suggest all of the limitations of claims 1 and 14.

Moreover, there is no motivation to combine the teachings of Vinson with those of Mogi et al. The teaching or suggestion to make the claimed combination must both be found in the prior art, not in applicant's disclosure. See MPEP §2143.

For at least the above reasons, it is respectfully submitted that independent claims 1 and 14 are patentable over Mogi et al. and Vinson. Claims 2-4, 6-8, 10-13, 15 and 16 depend, either directly or indirectly, from claims 1 and 14 and are therefore patentable over Mogi et al. and Vinson for at least the same reasons as claims 1 and 14.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the outstanding rejection of claims 1-4, 6-8 and 10-16 over Mogi et al. in view of Vinson.

B. Rejection of Claim 5 under 35 U.S.C. 103(a)

Claim 5 is rejected under 35 U.S.C. 103(a) as being obvious over Mogi et al. in view of Vinson and further in view of Seki (U.S. Patent No. 5,025,293). This rejection is respectfully traversed for the following reasons.

As indicated above, claim 1 is patentable over Mogi et al. and Vinson, at least in that there is no motivation to combine the teachings of Mogi et al. and Vinson et al. Moreover, even if combined, Mogi et al. and Vinson do not teach or suggest all limitations of claim 1. For example, Mogi et al. and Vinson neither teach nor suggest "a doping profile ... such that, within said body region and within at least a portion of said source and drain regions, the doping profile on one side of a centerplane of the body region is symmetric with the doping profile on an opposite side of the centerplane." Seki does not make up for these deficiencies in Mogi et al. and Vinson.

Therefore, claim 1 is patentable over Mogi et al., Vinson and Seki as well. Claim 5 depends indirectly from claim 1 and is therefore patentable over these references for at least the same reasons as claim 1.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the outstanding rejection of claim 5 over Mogi et al. in view of Vinson and further in view of Seki.

C. Rejection of Claim 9 under 35 U.S.C. 103(a)

Claim 9 is rejected under 35 U.S.C. 103(a) as being obvious over Mogi et al. in view of Vinson and further in view of Wolf et al. (ISBN 0-9616721-6-1). This rejection is respectfully traversed for the following reasons.

As indicated above, claim 1 is patentable over Mogi et al. and Vinson, at least in that (a) there is no motivation to combine the teachings of Mogi et al. and Vinson et al. and (b) even if combined, Mogi et al. and Vinson do not teach or suggest all limitations of claim 1. Wolf et al. does not make up for these deficiencies in Mogi et al. and Vinson.

Therefore, claim 1 is patentable over Mogi et al., Vinson and Wolf et al. Claim 9 depends indirectly from claim 1 and is therefore patentable over these references for at least the same reasons as claim 1.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the outstanding rejection of claim 9 over Mogi et al. in view of Vinson and further in view of Wolf et al.

CONCLUSION

Applicants submit that claims 1-16, 25 and 26 are presently in condition for allowance, early notification of which is earnestly solicited. Should the Examiner be of the view that an interview would expedite consideration of this Amendment or of the application at large, request is made that the Examiner telephone the Applicant's attorney at (703) 433-0510 in order that any outstanding issues be resolved.

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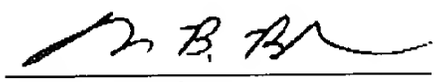
The Office is authorized to charge any fees required, including the $110.00 fee for a one-month extension of time to deposit account number 50-1047.

Respectfully submitted,



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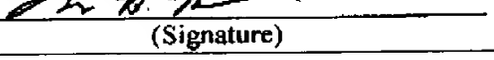

(Signature)

Version With Markings To Show Changes Made

IN THE CLAIMS:

~~17. A method of forming a trench MOSFET transistor device comprising:~~

~~providing a drain region of first conductivity type;~~

~~providing a body region of a second conductivity type over said drain region, said drain region and said body region forming a first junction;~~

~~providing a source region of said first conductivity type over said body region, said source region and said body region forming a second junction;~~

~~forming a trench that extends through said source region, through said body region and into said drain region;~~

~~forming an insulating layer over at least a portion of said trench;~~

~~providing a conductive region within said trench adjacent said insulating layer;~~ ~~and~~

~~providing source metal on an upper surface of said source region,~~

~~said method being performed such that (a) said body region is separated from said source metal, and (b) a doping profile along a line normal to upper and lower surfaces of said device is established in which, within said body region and within at least a portion of said source and drain regions, the doping profile on one side of a centerplane of the body region is symmetric with the doping profile on an opposite side of the centerplane.~~

~~18. The method of claim 17, wherein said drain region, said body region and said source region are provided by a method comprising:~~

~~providing a substrate of first conductivity type;~~

~~depositing an epitaxial layer upon said substrate; and~~

~~performing a source dopant ion implantation step and a body dopant ion implantation step such that the peak of the body dopant after implantation is one-half of the distance from the peak of the source dopant to the peak of the drain dopant.~~

~~19. The method of claim 17, wherein said drain region, said body region and said source region are provided by a method comprising:~~

~~providing a substrate of N-type conductivity;~~

~~implanting a first dose of P-type body dopant into said substrate;~~

~~depositing an N-type epitaxial layer over the implanted substrate;~~

~~implanting a second dose of P-type body dopant into said epitaxial layer; and~~

~~implanting an N-type source dopant into said epitaxial layer.~~

~~20.The method of claim 17, wherein said first conductivity type is N-type conductivity, wherein said second conductivity type is P-type conductivity, and wherein said drain region, said body region and said source region are provided by a method comprising:~~

~~providing a substrate of N-type conductivity;~~

~~depositing an epitaxial layer over said substrate;~~

~~implanting boron into said epitaxial layer;~~

~~growing an oxide layer on a surface of said epitaxial layer; and~~

~~implanting an N-type source dopant into said epitaxial layer.~~

~~21.The method of claim 17, wherein said drain region, said body region and said source region are formed by a method comprising:~~

~~providing a substrate of first conductivity type;~~

~~depositing an epitaxial layer of second conductivity type over said substrate; and~~

~~implanting source dopant of first conductivity type into said epitaxial layer.~~

~~22.The method of claim 17, wherein said body region and said source region are formed prior to trench formation.~~

~~23.The method of claim 17, wherein said body region is formed before trench formation and said source region is formed after trench formation.~~

~~24.The method of claim 17,~~

~~wherein said drain, body and source regions are silicon regions.~~

~~wherein said insulating layer is a silicon dioxide layer,~~

~~wherein said conductive region is a doped polycrystalline silicon region,~~

~~wherein said first conductivity type is N-type conductivity,~~

~~wherein said second conductivity type is P-type conductivity,~~

~~wherein said source and drain regions comprise the same doping material, and~~

~~wherein said source and drain regions have peak net doping concentrations that are greater than a peak net doping concentration of said body region.~~

25. The trench MOSFET transistor device of claim 1, wherein said trench MOSFET transistor device comprises a plurality of source regions which are shorted to one another.

26. The trench MOSFET transistor device of claim 14, wherein said trench MOSFET transistor device comprises a plurality of source regions which are shorted to one another.